

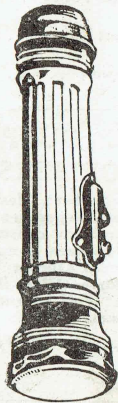
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11 MANNERS STREET, WELLINGTON.

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WELLINGTON, N.Z.
PERMIT No. 270

CONTENTS

	Page.
Electron Microscope in New Fields	1
The Home Recorder	3
The Measurement of Resistance	9
Hints and Kinks	18
Television	20
Class A Amplifier	22
The Dual Wave Midget Two	28

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11 Manners St., Wellington, C.1

The New Zealand
RADIOGRAM

Volume 11, No. 11. WELLINGTON, N.Z. NOVEMBER 1, 1944.
(Registered as a Newspaper). Published in Wellington on the first day of every month.

ELECTRON MICROSCOPE IN NEW FIELDS

By DR. V. K. ZWORYKIN.

From "Radio Craft."

Few innovations in the scientific world have made a place for themselves as quickly as the electron microscope; and no wonder. While for centuries previous to this remarkable contribution of radio, research men had been able to enhance the range of the visible world only by small steps, gradually perfecting the light microscope to its present high stage of excellence, the electron microscope almost at once revealed detail of structures up to a hundred times as fine as that visible with the earlier instruments. Within the past year the electron microscope, having been made commercially available has increasingly proved its value in the fields of biology, chemistry, and metallurgy. Its utility has been greatly enhanced by the development of new methods of observation.

OPERATION EXPLAINED

As the name implies, the electron microscope utilises electrons in place of light to form a magnified image of the object to be examined. As these minute charged particles, even when possessing a velocity comparable with that of light, do not readily traverse matter, the electron microscope must be carefully evacuated, i.e., freed of air. Furthermore, the electron rays cannot be focused in the usual fashion by material lenses or pass through a glass slide supporting the object. Finally, they cannot be observed directly by the human eye.

Under these conditions it is not surprising that the electron microscope presents an appearance differing greatly from that of the light microscope. Never-

theless, the basic arrangements of the two instruments are quite analogous. In the electron microscope electrons emitted by a hot filament are accelerated by a carefully stabilised difference of potential of about 60 kilovolts and concentrated by the "condenser lens"—the magnetic field between suitably shaped pole pieces of an electromagnet—on the object, which is usually supported by a collodion film about a two-millionth inch in thickness. After passing through the object and being partly scattered by the latter, the electrons are focused under the influence of a second "magnetic lens"—namely, the objective—into an intermediate electron image of the object. This is then further magnified by the magnetic "projector lens," which throws it on a luminescent screen so that it becomes visible to the eye. When the screen is replaced—by means of a simple turn of a knob—by a photographic plate, the image is recorded on it permanently. To facilitate the exchange of object and photographic plates, airlocks are provided at both points, making it unnecessary to evacuate the microscope anew after each exchange.

To further the application of the instrument in the field of biology, an RCA Fellowship for electron microscope research was established under the auspices of the National Research Council, and Dr. Thomas F. Anderson, of the University of Wisconsin, was appointed to the post. Collaborating with a large number of prominent scientists, Dr. Anderson has investigated numerous bio-

(Continued on page 12.)

BRIMAR VALVES



Bump! BANG! B-r-r-r! Bump! Bump! Jarring, crashing over incredible obstacles . . . and still Brimar Valves go through with flying colours — British colours, too! Ten times tested—ten times more efficient, Brimar have that extra margin of safety demanded for the vital part they play. Because Brimar Valves are built to "take it," they are the logical choice for all valve replacements. Fit Brimar in your Radio and be sure of long life and trouble-free service at all times.

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Standard Telephones and Cables Pty. Ltd., C.P.O. Box 638, Wellington; P.O. Box 982, Christchurch; P.O. Box 362, Wanganui; Electric Lamphouse Ltd., 11 Manners Street, Wellington; Mr. G. E. Tyler, Napier; Swan Electric Co. Ltd., P.O. Box 307, Auckland.

THE HOME RECORDER ADAPTABLE TO A GRAMOPHONE

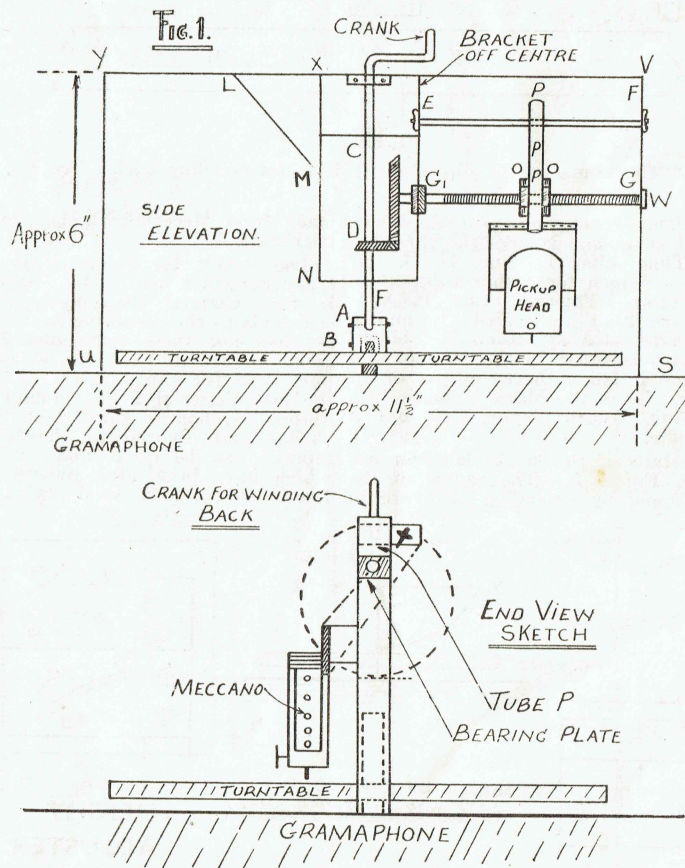
(BY RAHOB 9390).

(Original).

This is a small unit using a pickup and can be constructed, without any involved craftsmanship, for a negligible cost. Many will find that old Meccano strips are ideal for most of the metal-work. Figure 1 gives a general elevation of the unit which is fixed to a gramophone, from which the tone arm has been removed. All sizes are variable. They can be altered to suit each different constructor, and gramophone.

A word about the parts comprising this. In Figure 1 UVYS comprises

the main frame which may be made of brass, iron, or Meccano strips. XN and the corresponding strip, are a bracket also made of the frame material and LM is a brace. The main shaft F (coloured red) is driven from the sprig on the gramophone, AB. (This is shown in detail in Figure 2. This shaft drives the 2:1 ratio bevel gear, also Meccano, labelled CD. This rotates the threaded shaft G1G at half the speed of the turntable. This shaft is threaded with either 32 or 40 turns to the inch, and



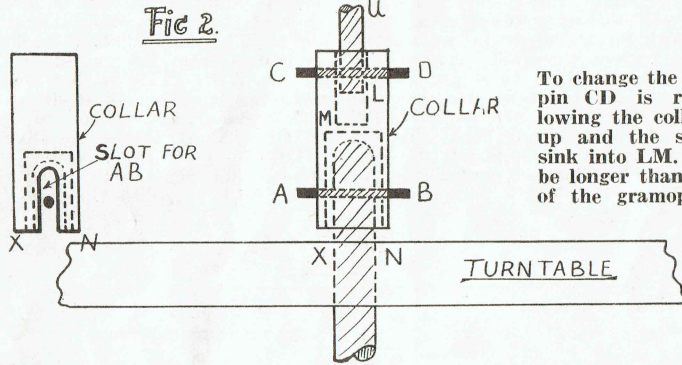
THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

so the nuts O, O (attached to the tube P) are drawn in 1-64th or 1-80th of an inch for each revolution of the turntable. This threaded shaft bears in W and is held by collars at G1.

EF is a rod wing-nutted at each end. This slides in a curved slot (shown in Figure 3) and controls the raising and lowering of the head. The tube P must be able to slide easily along this rod.

which the stylus is to move, through the bearing and on the slot plate. Thus the arc M1 N1 is found from MN. And the slot lies along M1 N1.

The bearing-plate can be made by drilling a hole the correct size, halfway through a piece of metal as in Figure 3. The bearing-plate for the main shaft with the crank is shown in Figure 4. The collars for the threaded shaft are



To change the record, the pin CD is removed allowing the collar to slide up and the shaft U to sink into LM. LM must be longer than the height of the gramophone sprig.

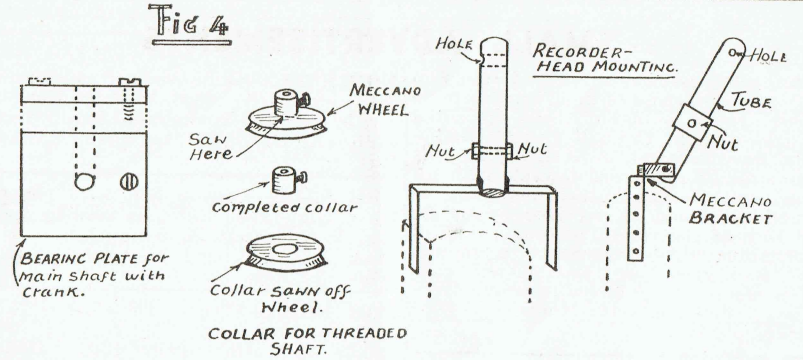
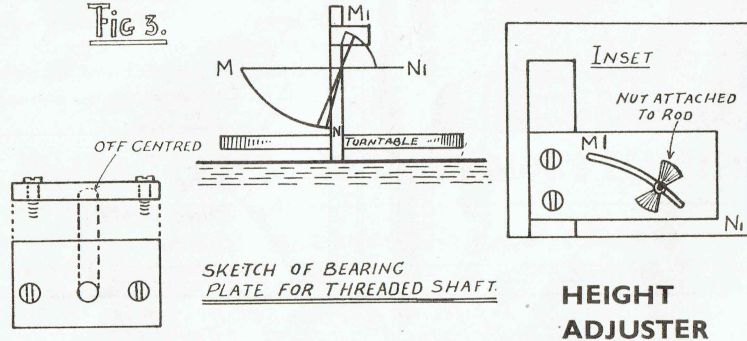
Note: The crank at the top of shaft U is for winding back. See Fig. 1.

In action, the rotating turntable drives the bevel gears and rotates the threaded shaft. This pulls the nuts O, O, in 1-64th of an inch for each revolution of the turntable. Thus the tube P, supporting the head is pulled in and a stylus engraves a spiral on the blank. This stylus is fitted in the pickup and the pickup is fed with the output of an amplifier. Thus the blank is made into a recording. When playing-back, use a fibre needle.

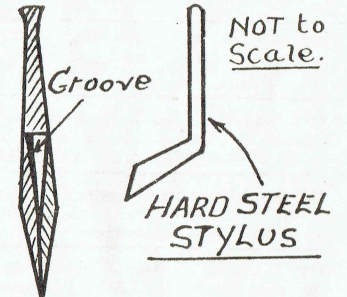
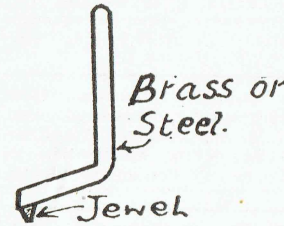
The details of the height adjuster are found in Figure 3. The radius of the slot is found by extending the arc in

made from Meccano wheels, also shown in Figure 4.

The circuit for recording is an ordinary amplifier with mike and tuner inputs. Connect the extension speaker terminals to the recording head. If your set has not these terminals, Figure 5 gives the circuit. A is for push-pull output, B is for single valve. For blanks the best material I have found is light fibrous cardboard thickly coated with shellac and allowed to harden. Aluminium can be used and old records which have been filed smooth will do. Use a sharp, hard steel stylus, or else

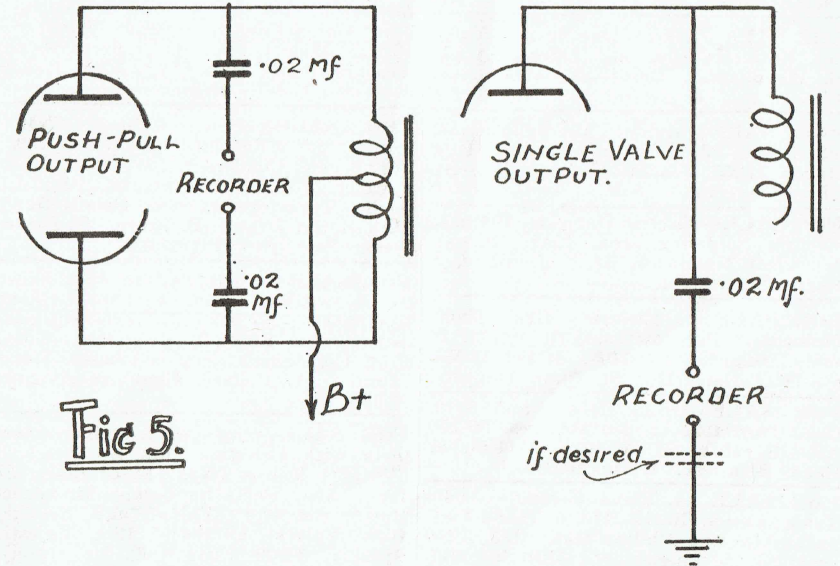


a jewel stylus as in Figure 5. When the record is made, lift the drive collar and raise the head. Take the completed record off and rotate the crank, thus winding back the head. The completed record will stand seven or eight play-backs if a fibre needle is used. Although these recordings are not absolutely perfect they give a moderately good playback.



ENLARGED

TWO TYPES OF STYLUS



SMALL ADVERTISEMENTS

An advertisement in the Radiogram will quickly dispose of your surplus radio parts. Hard to obtain goods are often brought to light through a small Radiogram advertisement. Advertising on this page costs 2d. per word payable with instructions. To ensure inclusion, your instructions should be received by us on the 15th of the month preceding date of publication. Advertisements addressed c/o "Radiogram" or "Lamphouse" can not be accepted. Address instructions to "The Radiogram," 11 Manners Street, Wellington, C.I.

FOR SALE—Hiker's Two, £5. G. S. D. Heather, 5 Hill St., Hamilton.

FOR SALE—1 3 gang Variable Condenser. What offers? A. Biland, Te Rapa R.D., Frankton Junction.

FOR SALE—1 12in. Rola P.M. Speaker (Special); price £8 10/-. Rahob 11055, c/o 90 Forbury Road, St. Clair, Dunedin.

FOR SALE—One 3 Gang Variable Condenser. What offers? A. Biland, Te Rapa, Frankton Junction.

FOR SALE—Steam Engine, good as new, had little use, £1 or nearest offer. D. Wagener, P.B., Awanui (Rahob 12265).

FOR SALE—1 10in. Plessey P.M. Speaker, in new condition, £6 10/-. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

FOR SALE—Hiker's One, in neat Cabinet, Batteries, Phones. Offers. Apply B. Woodham, 3 Carey St., Wellington, W.1.

FOR SALE—Crystal Microphone, on stand, with 35ft. Flex and Plug, £9 10/-. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

FOR SALE—Electric One-valve Set, £2; Electric Soldering Iron, 15s; Shaw's Electrical Handbook, £1. J. Ward, 8 Gorrie St., Nelson.

FOR SALE—Electric Gramophone Motor and Pick up (modern outfit), in first-class order, £10 10/-. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

FOR SALE—Gram. Motor and 11in. Cast Turntable, tapped voltages, 50-250 AC/DC, £6. M. Riddle, 66 Calabar Road, Miramar, Wellington.

FOR SALE—Three Ferranti Audio Transformers. Ratios 1/3, 1/7 and Output. Also one Philips Ratio 1/3, 12/6 each. J. A. Patrick, 86a Hill St., Wellington.

FOR SALE—Swan Audio Transformer, 3-1, new, 12/6; .0003 Variable Condenser, 3/-; Akrad Kodagraph, hardly used, 17/6. A. H. Dally, Makotuku, Hawke's Bay.

FOR SALE—Crystal Set, with phones, 35/-; High-grade Buffs, as used by leading electro-platers, 4. 5 and 6in. x 1in. thick, 3/9, 5/6, and 8/- each. Rahob 8845, 14 Alba Rd., Epsom.

FOR SALE—Wright De Coster 14in. P.M. Speaker, heavy duty type; will handle 35 watts. Price £20. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

FOR SALE—Universal Velocity Microphone on adjustable stand, nickel plated, with 35ft of flex and plug, in new condition; price £27 10/-. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

FOR SALE—Hiker's Two New Batteries, Metal Chassis Cabinet, 4 Plug-in Coils, Vernier Dial, £6; Phones, 15s. A.C. Oscillator, three Valves, Speaker, Volume Control, Cabinet, £4 10/-. Key 15/- Arnold, Box 279, Hawera.

FOR SALE—Quantity New and Used Valves, 0/1 Millimeter, Universal scale, 1000 O.P.V. Meter, 5-valve Amplifier, Typewriter. Particulars to Brown, 24 Pompalier Terrace, Ponsonby, Auckland.

FOR SALE—"Ferranti" Audio Transformer, 3-1, 10s; I.C.S. 3-in-1 Tuner, 30s; Two Gang Condenser and Trimmers, 10/6; Midget Portable Gramophone, measures 6in. x 5in x 7in., £1 10s. Rahob J. Wells, Box 7. Milton.

FOR SALE—385-volt Power Transformer, 2.5 Filaments, practically new, 35s; 3 gang Condenser, 15s; Small Horn Speaker, 15s; New 53-valve, 10s; 4.1 Audio Transformer, 10s; Small 6-volt D.C. Meter, 7/6. J. B. Rowe, 359 Devon Street East, New Plymouth.

FOR SALE—Hiker's Two in Cabinet 21½in. x 10in. x 9in., with or without headphones; no batteries; excellent condition; also Small Carbon Microphone, Ford Coil, single gang condenser. What offers? A. Pollard, Chalmers Avenue, Ashburton.

FOR SALE—Parts of Amplifier, complete with Celestion 10in Speaker, 3 6V6GTG Valves (No. 6J7 or 6C5), £7 10/-. Also, Parts for 6-valve Broadcast Radio, complete Valves and Speaker (6.3v. Valves), £9 10s; 1 12in. Majestic Speaker, 1,000 Field Coil, no tranny, £1 10/-. R. Gardner, Denniston.

SMALL ADVERTISEMENTS—Continued

FOR SALE—Valves, 6K7, 42, 12A7, 7/6 each; 80, 2/6; 2 gang Condenser, 7/6; Single Gang, 5/-; 6 x 6 mfd., Electrolytic, 5s; Power Transformer 6v., 5v., 385v., 100 M/A Windings, 25s; 2 465 K.C.L.F.'s, 7/6 each; 200,000 ohm Potentiometer, 2/6. M. Downey, 53 Wallace Street, Wellington.

FOR SALE—Powerful 16 Valves Beam Power Amplifier, 80 watts output and separate power supply. Incorporated with 4 pre-amps, input channels and pick-up with twin magic eyes as volume indicator. Has enough volume for the largest dance hall in N.Z. and wonderful outfit for public addresses. First in gets this one, £85. Rahob 11055, c/o 90 Forbury Rd., St. Clair, Dunedin.

WANTED TO SELL, Phillips B and C Eliminator. What offers? Rahob 8662, 9 Alma Street, Dannevirke.

WANTED TO SELL—30 Watt Inverse Feedback Amplifier, with 2 speakers, microphone; modulate 150 watt, 2 valve, electric, complete. N. Martin, 29 Cockayne Road, Wellington, N.5.

URGENT SALE—One Dualwave (19-50M & B.C.) coilkit, wired and tested, with AVC and 1RF Stage. Complete with matched 3 Gang Condenser and two Iron-core I.F.S. All brand new condition, £5 10/-. Particulars from J. Jackson, Hotel Esplanade, New Brighton, Christchurch.

CRYSTAL PICK-UPS and MICROPHONES—Limited stocks arriving. Order yours now. Write R. C. Walker, 252 Willis Street, Wellington.

WESTINGHOUSE, ½ h.p. Split Phase Electric Motors, £6. The Lamphouse.

WORKING MODEL STEAM ENGINES, 37/6 each. The Lamphouse.

SUPREMACY, the great war game, 19/6 per set. The Lamphouse.

RAHOBS—Spare Club Badges can be obtained from the Secretary, 9d. each.

HIGH PRICE offered for G12 Permanent Magnet Speaker, in good condition. S. C. Cummins, Pokuru, Te Kawa.

SWAN ½ amp. 6-volt Battery Chargers, 80/- each. The Lamphouse.

ELECTROSHINE—The silver plating liquid, 2/3 per bottle. The Lamphouse.

TRANSFORMER and Armature Rewinds. Send for price list, quotes given for special jobs. M. J. Begley, c/o A. Zeinert, Mangamutu, Pahiatua.

WILL PAY GOOD PRICE for Portable Gramophone, with or without records. Rahob 7202. M. Karipa, c/o Patea Freezing Co., Ltd., Patea.

WANTED—Midget, 5 or 6in. P.M. Speaker, Edwards, Box 12, Waiuku.

WANTED—Pea Lamp, complete. Apply R. J. Toxward, Rectory, Gisborne.

WANTED—Electric Hikers One. Rola G 12in. Speaker and 5in. P.M. J. Ramsay, Pokeno.

WANTED—Small Comutator Type Electric Motor, for Gramophone. G. S. D. Heather, 5 Hill St., Hamilton.

WANTED—Two good 1S4 Midget Valves. G. Rigg, 16 Devon Street, Masterton. (Rahob 6487).

WANTED—0-1 M.A. Meter, or Pifco Rotometer or Radiometer. Write R. Young, Manaia. (Rahob 4529).

WANTED, a Pair Good Headphones, about 2000 ohms, 30s. Write D. Akrigg, "Elgin," Exeter, New South Wales.

WANTED—100 to 150 ft. of Tinned or Plain Copper Aerial Wire. G. W. Young, Tahuna Road, Morrinsville.

WANTED—Small Modern 2-volt Radio Set, 4, 5, valves; pay good price. Write D. Herbert, Waieuru P.B., Dannevirke. Rahob 10951.

WANTED—One Pickup (not too expensive), also an Electric Motor for a gramophone. R. S. Wilberfors, Box 434, Wanganui.

WANTED—Slow-motion Instrument Knob. For Sale, Oxford Voltage Reducer, 230, 6 volts; good condition; offers. J. Norris, Grey St., Whangarei.

WANTED—a copy of the "Radio News" of September, 1935. Will pay 5/- for a good copy. T. H. Bransgrove, 211 Devon St., New Plymouth.

WANTED—Two Midget Variable Condensers, 23 Plate, .0001 and one 13 Plate, .0003. Write Chas. Soufflot, No. 2a Flag Staff Hill, Wellington, C.I.

WANTED—0-1 M.A. Meter, with or without rectifier. Whiting, "Willowbank," Mayfield. Mr. R. Whiting, 74 Middle Road, Allerton, Ashburton. (Rahob 4795).

WANTED—Pair of Bagpipes, suitable for beginner; also Latest Records, must be in good order. Price and particulars to B. C. Bain, Hukerenui, North Auckland.

WANTED TO BUY—N.Z. Listener, containing photos of N.Z. members of Parliament. Write W. W. Sides, c/o R. A. Hayman, Esq., Willowbridge, R.M.D., Waimate.

WANTED TO BUY, or donations of Used Postage Stamps, or Collections, large and small lots appreciated. Rahob No. 12603. H. F. Mitchell, Services Hospital, Rotorua.

SMALL ADVERTISEMENTS.—Continued.

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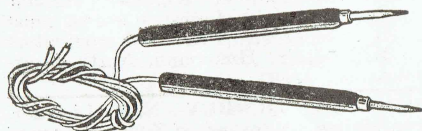
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Telsen (4 point D.P. On/Off) Switches for panel mounting.

Cat. No. MS438 3/5 each

TEST PRODS



Polished ebonite handles and complete with flexible leads.

Cat. No. MM1 7/- pair



Slips at The Mike

One shilling paid for every "slip" published; 5/- for particularly good ones.

2ZB, September 8, 1944, 9.18 a.m.: Aunt Daisy: "If you have a pocket with two aprons in . . ."

2ZB, September 15th, 1944, Aunt Daisy describing her experiences in Hollywood: "Then there are the tables you sit under . . ."

2ZB, September 19th, 1944, 7.55 p.m.: "I didn't think he would ever put a woman round his arm—er. . ."

2YC, September 16th, 1944, 7.15 p.m.: "When My Dream Goat Comes Home."

An American Station. Stock market report: "Pigs have gone up by 3 cents."

2KY, 28/9/44, 8.30 (N.Z. time), in "Postard's Shoes" session: "Equipped with hot and cold shadows."

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Behind the name Osram there are years of lamp-making experience, huge laboratories, research workers, and finest materials. That's why you can always be sure that when you buy an Osram Lamp you are buying the best. But they cost no more.

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- 60 WATT 2/3
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- 200 WATT 10/3

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THE MEASUREMENT OF RESISTANCE

By J. W. STRAEDE, B.Sc.

(From the Australasian Radio World)

Maybe it's a speaker field, or just a resistor with colour chipped off. How do you measure its resistance?

Resistance is **invariably** measured by the voltage drop across it when a certain current flows. Invariably. The basic principle is Ohm's Law, one form of which states that the voltage drop across a resistance is equal to the product of the current in amperes and the **resistance in ohms.**

SIMPLE METHOD.

This leads to a very simple, but not very accurate method. A 1½-volt dry cell is connected in series with a milliammeter and the resistance to be measured. The meter reads the current flowing and the voltage drop is assumed to be nearly all of the 1½ volts. Suppose the meter reads 25 ma., or .025 ampere. Then E equals $I \times R$ and R equals E/I where E is voltage drop, I equals current in amperes and R equals resistance in ohms.

$$R \text{ equals } EI/$$

$$= 1\frac{1}{2} \text{ divided by } 0.25$$

$$= 1\frac{1}{2} \times 40 = 60 \text{ ohms.}$$

NOT ACCURATE.

This method is not very accurate because the voltage drop across the unknown resistance is not 1½ volts. Part of the voltage (electrical pressure) is used up across the cell itself and across the meter. Besides, if the resistance happens to be too small, then too much current will flow and burn out the meter, or at least bend its pointer.

The accuracy may be considerably improved by using a separate meter, a voltmeter, to measure the actual voltage drop across the resistance, but again inaccuracy must occur, because a small part of the current goes through the voltmeter instead of through the unknown resistance.

In ordinary "multi-meters" and "volt-ohm-meters," only one meter, a milliammeter is used. To make up for the drop in voltage across the meter and cell or battery, a large resistor is inserted in series with them and adjusted until the total resistance of battery (or cell) meter and resistor is equal to some fixed value, usually such that the meter gives full scale deflection with zero external resistance. As the resistance to be measured in-

creases, the meter reads less and less. (The meter is said to be backward reading.) Finally the deflection of the meter needle is too small to be measured, thus setting an upper limit to the resistance that can be measured. The resistance of the battery or cell changes with age so that there is another reason why an adjustable resistor is required in the multi-meter.

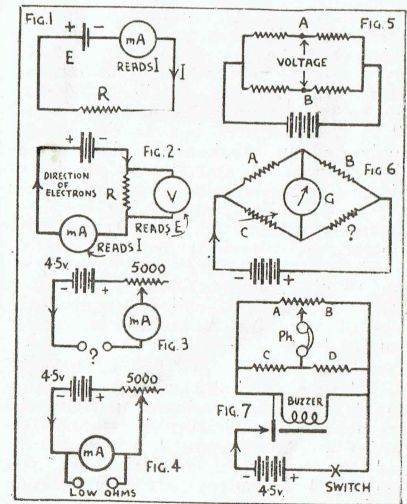
LOW OHMS.

For low resistances the unknown resistance may be connected in parallel with the meter, thus bypassing some of the current. As the resistance to be measured is made less so more current is bypassed and the meter read less. The higher the meter reading, the greater the resistance. Such "low-ohm" meters are therefore "forward-reading."

All the methods considered so far depend on the accuracy of calibration of the meter (s). Small commercial meters may be calibrated to within 2 per cent., but even 1 per cent. is sometimes too much variation, so more accurate methods must be considered.

BRIDGE METHODS

Resistance may be compared with the resistance of some "standard" (which may have been measured by a University



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to, say, one part in 100,000). A simple method is the "Wheatstone Bridge" invented by a man named Christie. If four resistors are connected in series parallel to a battery, then a voltage may be found between the resistor junctions not directly connected to the battery. If all the resistors are equal in value, or if they have values according to a certain rule, then this voltage disappears.

The disappearance of the voltage may be found by a sensitive galvanometer. The rule for this disappearance of voltage, or "balancing" of the Wheatstone Bridge is:—

$$A/B \text{ equals } C/D$$

where A and B are the resistances in one arm of the bridge and C and D are the resistances in the other arm.

In practice, A and B are made equal, or in some convenient ratio such as 1:10 or 100:1. They are, therefore, called the "ratio arms." C is an adjustable resistance which is calibrated i.e., has a scale giving its values, whilst D is the unknown resistance to be measured. C is adjusted until the galvanometer G reads zero.

Then D equals value of C, multiplied by B and divided by A;

$$\text{or } D \text{ equals } C \times B/A$$

This "bridge" method is most accurate as the galvanometer does not have to be calibrated.

A.C. CIRCUIT.

If the circuit is supplied with A.C. instead of D.C. then an A.C. meter, a loudspeaker, or even a pair of phones may be used in place of the galvanometer. In fact, an excellent "bridge" may be wired up using a buzzer and cell in a soundproof box as the current supply and an earphone in place of the galvanometer. A and B may consist of a length of resistance wire and C can be a good quality resistor that has been accurately checked by some friend with a meter, or a specially accurate one obtained from the factory. Next month we hope to give constructional details of a "Metre Bridge," so called because the piece of wire for A and B is exactly a metre long.

Because A.C. will "pass through" a condenser (actually what really happens is that the condenser permits the current to keep flowing back and forwards) an A.C. operated bridge can be used to compare capacities of condensers. Inductances may also be compared.

Weather and U-S-W

From "Wireless World."

Some interesting facts regarding the influence of weather on the propagation of ultra-short waves emerge from a study of the records of signal strength variations in the Post Office radio telephone link between Guernsey and England from 1937 to 1939.

The path between stations was about 85 miles in length over sea, of which 36 miles was outside the optical range; the wavelengths employed were 5 and 8 metres. Continuous records taken by the Post Office were analysed by Dr. R. L. Smith Rose and Miss A. C. Strickland, M.Sc., to show correlation between signal strength and atmospheric conditions. The results are given in a paper recently read before the I.E.E.

It is clearly established that weather has an influence on the variations of signal intensity. During periods of high barometric pressure, often accompanied by temperature inversions, signal strength was at a maximum, but there was much fading of the slow type. Low-pressure conditions with very little temperature inversion gave the steadiest signals though of rather low level. Snowy and foggy weather also gave a steady signal even when the atmospheric pressure was high.

The authors conclude: "It seems clear that the main agencies causing variations in signal intensities on these wavelengths are the variations in refractive index of the air in the lower atmosphere, due notably to changes in moisture content, and in addition the presence or absence of temperature inversion layers from which the waves can be reflected at heights of from a few hundred to a few thousand feet."

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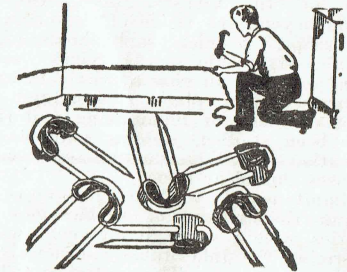
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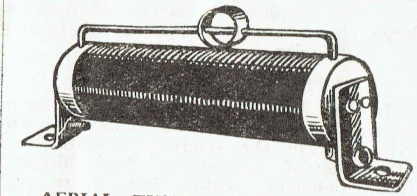
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